INTERSPIRO

MODULE 2-3

SERVICE AND REPAIR MANUAL

DIVATOR DP1 Surface Supply

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1 INTRODUCTION

This service and repair manual describes the recommended service as well as repair of the Divator DP1 Surface Supply Unit.

The recommended time between services, including replacement of service parts, is based on international standard requirements as well as on Interspiro's experiences and tests.

Service intervals are defined in the Service and Test Schedule in the user manual

The technicians, performing any service or repair work on any Interspiro breathing apparatus, must be trained and certified by Interspiro on the specific apparatus.

The manual is divided into three chapters describing:

- **Annual Service** – including the operations to be performed and service parts to be replaced at an annual service
- **Six-year Service** – including the operations to be performed and service parts to be replaced at six-year service.
- **Repair** – set out instructions for the dismantling and assembling of the repairable assemblies.

Each chapter describes what needs to be done during service, provided that the equipment is not damaged. For such equipment, repair work can be done according to chapter Repair.

1.1 GENERAL SERVICE STEPS

- **Cleaning** – before any service or repair it is recommended to completely clean the equipment according to the user manual.
- **Service** – certain parts need to be replaced to ensure a high degree of safety.
- **Checking** – certain parts listed in each section need to be checked.
- **Testing** – service and/or repair work on the equipment shall always be completed by a full functional test.

1.2 THE SURFACE SUPPLY UNIT

The Surface supply unit consists of the following subassemblies:

- Surface supply panel with valve block, pressure gauge, warning whistle hose and cylinder connections.
- Diving hose with reliving loops and P+ regulator with anti-freezing unit.

2 ANNUAL SERVICE

1 Year

This chapter describes everything that needs to be done during annual service, provided that the equipment is not damaged. For damaged equipment, repair work can be done according to chapter Repair.

This chapter is divided into the following parts, which should be carried out in chronological order:

- External cleaning of regulator unit with hoses.
- Checks of cylinder connection, pressure gauge and hoses.
- Replacement of anti-freezing cap, inlet filter and O-ring in high pressure connection.
- Full functional test

2.1 TOOLS & CONSUMABLES

TOOLS	PART NO
- Fixture, regulator	460 190 855
- Screwdriver, slotted, 5,5 x 100	460 190 767
- Hexagonal key 5 mm	460 200 008
- Spong	-
- Washing brus	-
- Vice	-

CONSUMABLES PARTS	PART NO.	NOTES
Clocking compund	460 190 846	
Silicone lubricant	331 900 269	
Curacid PSA Rinse, 1 L	336 921 330	or hand detergent, low pH
Lint free cloth	-	

2.2 SERVICE KITS

All service kits and service parts listed below shall be replaced during service.

SURFACE PANEL	PART NO.	NOTES
O-rings & filter for high pressure connections, 1 unit	460 190 701	

DP1 REGULATOR P+	PART NO.	NOTES
Anti-freezing cap, 6 pack	460 190 507	6 x 336 100 425

DP1 T-STYCKE	PART NO.	NOTES
O-ring for T-pice, 10 pack	336 190 272	10 x 331 100 767

2.3 CLEANING

1. Assemble hose, surface unit and air supply (both connections must be connected). Open the cylinder valves. Before cleaning, check the pressure gauge reading. If the pressure gauge shows that the air cylinder pack contains less than 65 bar (6.5 MPa or 945 psi) the air cylinder pack must be replaced or filled before you continue. If the system has not already been pressurized, do so now.
2. Place the unit on a washing surface. Use low-pH hand detergent/soap, a washing brush and a sponge. Rinse off with a hose or pressure jet (do not apply a pressure jet to the warning unit or the P+ regulator).
3. Position the equipment so that the water drains off and does not collect in the box.

2.4 CHECKING

If a part fails on checking, replace it as described in chapter Repair and correct the fault. Then resume the inspection where it was stopped.

2.4.1 INSPECTION OF HOSE/LIFELINE

▶ **Hose**

If the hose shows any visible signs of damage, bending or creases, it should be sent to Interspiro for repair, which is ordered using item number 30617-01. During repair, the damaged area, plus an extra meter, is cut off from the hose, a new end nipple is fitted and the hose is pressure tested. If the damage is a long way from any of the ends of the hose, the hose will be dealt with according to an agreement between Interspiro and the user.

Check that there are no deposits. If there are, remove them and resume inspection under them.

Check that there are no discolorations caused by chemical attack, for instance. Chemical attack may weaken the hose. If the hose is used in environments where it may be subject to chemical attack, keep a detailed log.

>>> **NOTE**

Even if the equipment was cleaned as described in Section 2.3, contamination by chemicals may still harm the person servicing the equipment. Make sure that the hose has been thoroughly decontaminated and neutralized. Special training in decontamination and neutralizing is needed.

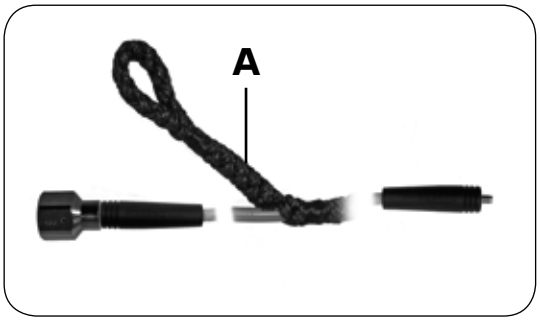
If you suspect that the hose has been affected by chemicals or that chemicals have penetrated the outer sheath, the hose should be replaced.

The lifetime of the high pressure hose is eight (8) years from when the hose was completely manufactured.

The year of manufacture is determined by the date for the pressure test stamped on the hose connection nipples in the format “P” + YY.

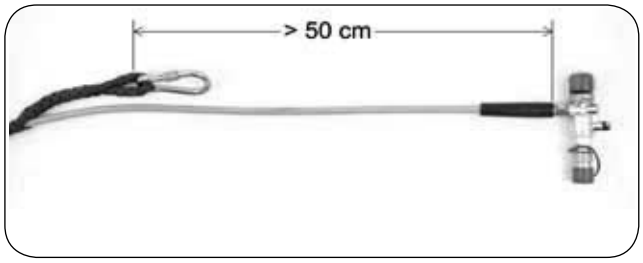
The eight (8) year life time applies only under the conditions that the hose is handled and inspected in accordance with safety bulletin “31574B01 – Divator DP1 Supply Hose/Lifeline”

▶ **Relieving loops**



Check the relieving loops (A) of the diving hose for wear and mechanical damage. Check that the whippings and tapings are intact.

Check that the free end of the supply hose connected to the MKII P+ regulator i minimum 50 cm (20 inch) loong (meassured from connection nipple to the releaving loop eye. according to illustration below).

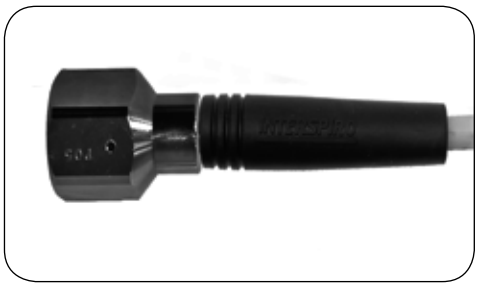


▶ **Safety belt, carbine hook**

Check the seams and check for corrosion on the hooks. Check that the hooks run easily on the safety belt and that it locks. Check the seams and check that the belt has not suffered chemical attack, nor changed colour or shape.

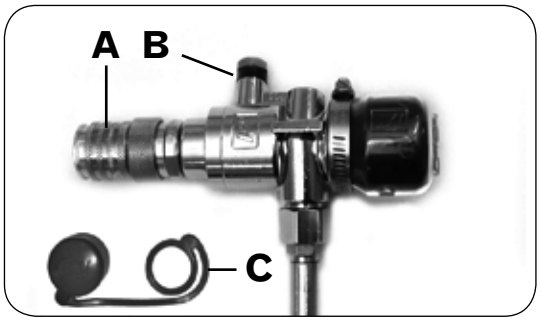
Check the carbine hook for mechanical wear and changes of shape.

▶ **Connection R5/8"**



Check the thread and air holes for mechanical wear and deposits.

▶ **P+regulator**



▶▶**Relief valve**

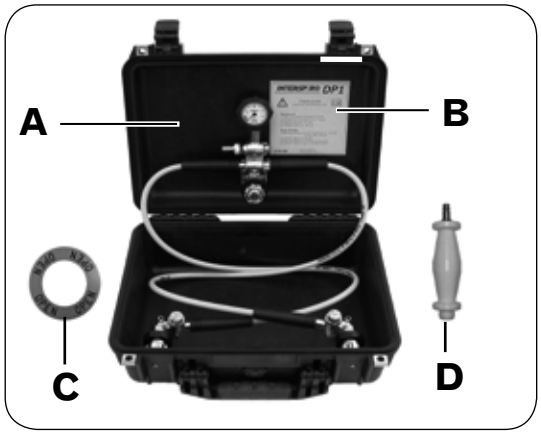
Check that the protective band (B) on the relief valve is not damaged. Check the safety valve for mechanical wear.

▶▶**Quick coupling**

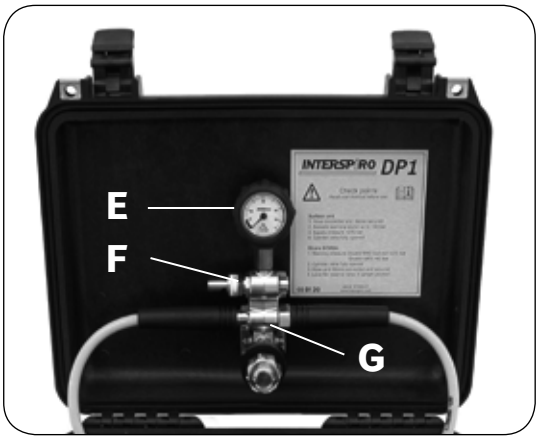
Check that the quick coupling (A) is undamaged and clean. Check for mechanical wear. Check that the quick coupling cover (C) is intact.

2.4.2 INSPECTING THE SURFACE UNIT

▶ **Surface panel box**



1. Check that the surface panel box (A) is undamaged and that the instruction label “Check points” (B) can be read.
2. Check that the “OPEN” ring (C) and the pressure relief handle (D) is present.



▶ **Valve block**

Check that the valve block has no mechanical damage.

▶▶**Pressure gauge**

Check that the pressure gauge (E) is free from scratches and other mechanical damage.

▶▶**Whistle insert**

Check the whistle insert.

Check that the retaining ring and locking clip (F) are in place.

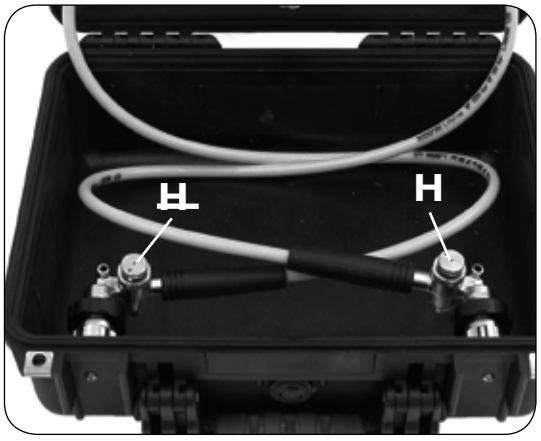
▶▶**Shuttle insert**

Check the shuttle insert (G) for deposits and mechanical damage.

Check that the shuttle insert can swivel.

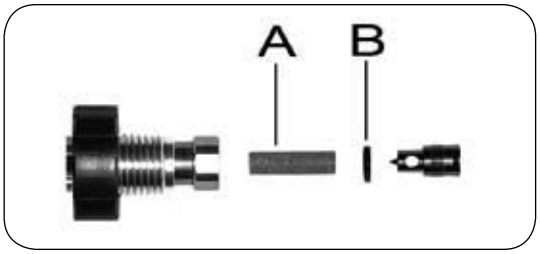
Check that the retaining ring and locking clip are in place.

▸ Valve block / connection manifold



Check the valve block (H) for deposits and mechanical damage. Check that the venting part of the valve block can swivel.

2.5 ANNUAL SERVICE



Content:

- Connection nippels - exchange Filter & O-rings
- T-pice - change O-rings

2.5.1 CONNECTIONS

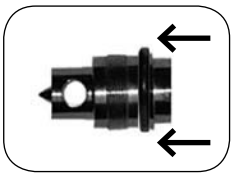
▸ Valve block / connection manifold

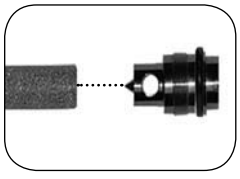
▸ Connection manifold and Valve block

▸▸Filter and O-rings

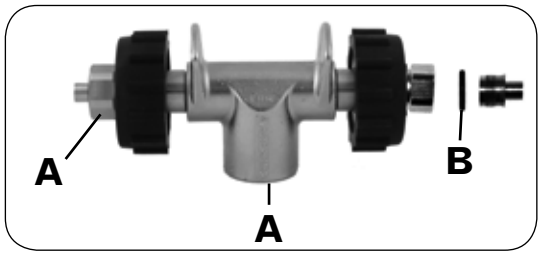
1. Unscrew and remove the nipple with help of a 5 mm hexagon wrench.
2. Remove and discard filter (A) fall out of the connection nipple

3 . Carefully knock the connection nipple against a soft surface, to let that any possible loose particles fall out.
4. Remove and discard the O-ring (B) from the nipple.
5. Apply a thin layer of silicone lubrication on the a new O-ring (B) and position is in the grove of the nipple.
7. Drop a new filter (A) down into the connection nipple. The filter shall be centred so that the point of the nipple fits into the hole in the filter. Screw in and tighten the nipple by hand to stop using a 5 mm hexagonal wrench.





▶T-piece



Check that the threaded connections (A) not are damaged.

▶Replace the O-rings

1. Unscrew and remove the nipples in both ends with help of a 5 mm hexagon wrench.
2. Remove and discard the O-rings (B) from the nipples and clean the threads from locking compound residue from.
3. Apply a thin later of silicone lubrication on two new O-rings and attach them in the groove on each nipple ends.
4. Apply two drops of locking compound on the threads of the nipple.
5. Fit the nipples into the connection nipples. Tighten the nipples gently by hand (torque 1 Nm).

2.5.2 ANTI-FREEZING CAP

▶ Important about the anti-freezing cap

Moisture can penetrate into the regulator from the air supply, damaged hoses, fittings or via the anti-freezing cap.

This moisture can lead to a risk of internal freezing but also cause corrosion inside the regulator. It is important to regularly inspect the antifreeze bladder with respect to moisture.

The antifreezing capshall be replaced when performing the annual maintenance.

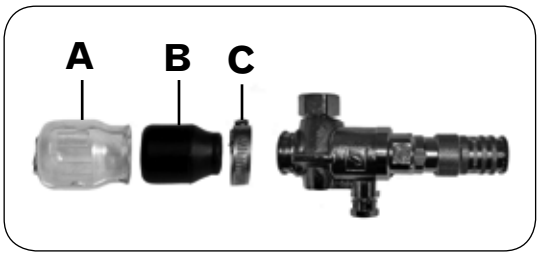
Antifreezing cap also functions as a pressure relief valve in case of a leak from the regulator.

It is therefore important to frostskyddshättan and its protective cover is mounted in the right way .

NOTE

A leaking anti-freezing cap not only increases the risk of freezing, it makes the regulator work less efficiently. Oxides and salt deposits in the regulator may adversely influence the high levels of performance associated with Interspiro products.

▶ Remove the anti-freezing cap



1. Remove the hose clamp (C) from the anti-freezing cover (A) with a screwdriver.

2. Open the hinged anti-freezing cover and remove the anti-freezing cap (B) from the groove on the regulator housing. Discard the antifreezing cap.

3. Check that no water has leaked in to the regulator. If water has leaked in the regulator must be blown dry completely.

▶ Dry blowing

Blow dry compressed air into one of the two air ducts that connect the underside of the regulator piston to the anti-freezing cap until no moisture comes out of the opposite air duct.

▶▶ Mount the anti-freezing cap

1. Pull the new anti-freezing cap (B) carefully over the flange on the regulator. Gently pull on the lower edge of the anti-freezing cap, then release so that it is completely filled with air. There should now be a gap of about 1 mm for the anti-freezing cover (A).
2. Fit the anti-freezing cover (A) over the anti-freezing cap and secure it with the hose clamp (C) with help of a screwdriver. Make sure that the plastic halves do not pinch the anti-freezing cap (B). The clip must be tightened moderately. Check this by manually turning the anti-freezing cover (A). The anti-freezing cap (B) must not rotate with the anti-freezing cover.

2.5.3 TESTING

▶▶ Testing in a test unit

The DIVATOR DP1 must be tested with Interspiro test equipment at every annual or six-year inspection and after repair at a service workshop.

For a general description of and operating instructions for the test unit, see the user manual for the test equipment. Tests must be done in accordance with test protocol for DIVATOR DP1.

▶▶ Logging of test results and comments

Test results must be logged according to the instruction for the specific test equipment.

3 SIX-YEAR SERVICE

6 Years

This chapter describes everything that needs to be done during six-year service, provided that the equipment is not damaged. For damaged equipment, repair work can be done according to chapter Repair.

This chapter is divided into the following parts, which should be carried out in chronological order:

▶ **Cleaning**

Every form of service must be preceded by cleaning.

▶ **Checking**

Certain parts need to be checked.

▶ **Service**

Certain parts need to be replaced to ensure a high degree of safety.

▶ **Testing**

Service and repair work on the equipment shall be completed by a full functional test.

3.1 TOOLS AND CONSUMABLES

▶ **Tools**

- Assembly tool for whistle	95 926-01
- Assembly tool for shuttle valve	95 925-01
- Awl	460 190 768
- Circlip pliers	460 200 519
- Fixture, whistle	460 190 848
- Fixture, regulator	460 190 855
- U-spanner, 10/13 mm	460 190 774
- U-spanner, 18/19 mm	460 190 755
- U-spanner, 20 mm	460 200 010
- U-spanner, 24 mm	99 519-51
- Screwdriver, 1 x 5,5	460 190 767
- Piston extractor	99 211-01
- Protective pin	460 190 565
- Punch tool	460 190 566
- Punch tool for Shuttle valve	31 272-51
- Socket, whistle	460 190 849
- Barrel brush	460 200 030
- Torque wrench assy, 5-50 Nm	336 190 478
- Torque wrench adapter, 13/15 mm	460 190 852
- Torque wrench adapter, 21/26 mm	460 190 773
- Vice	-
- Ball hammer	-
- Lint-free cloths	-
- Washing brush	-
- Sponge	-
- Breathing valve (tested and approved)	

▶ **Consumables**

- Curacid PSA Rinse, 1 L or hand detergent, low pH	336 921 330
- Locking compound	460 190 846
- Silicone lubricant	331 900 269
- Cotton buds	-

3.2 SERVICE KITS

SURFACE SUPPLY UNIT	PART NO	NOTES
Service kit for 1 unit	460 190 702	

DP1 REGULATOR P+	PART NO	NOTES
Service kit for 1 unit	460 190 703	

3.3 CLEANING

1. Assemble hose, surface unit and air supply (both connections must be connected). Open the cylinder valves. Before cleaning, check the pressure gauge reading. If the pressure gauge shows that the air cylinder pack contains less than 65 bar (6.5 MPa or 945 psi) the air cylinder pack must be changed or filled before you continue. If the system has not already been pressurised, do so now.
2. Place the unit on a washing surface. Use low-pH hand detergent/soap, a washing brush and a sponge. Rinse off with a hose or pressure jet (do not apply a pressure jet to the warning unit or the P+ regulator).
3. Position the equipment so that the water drains off and does not collect in the box.

3.4 CHECKING

■ If a part fails on checking, replace it as described in chapter Repair and correct the fault. Then resume the inspection where it was stopped.

3.4.1 INSPECTION OF CONNECTION HOSE AND LIFELINE

▶ Hose

If the hose shows any visible signs of damage, bending or creases, it should be sent to Interspiro for repair, which is ordered using item number 30617-01. During repair, the damaged area, plus an extra meter, is cut off from the hose, a new end nipple is fitted and the hose is pressure tested. If the damage is a long way from any of the ends of the hose, the hose will be dealt with according to an agreement between Interspiro and the user.

Check that there are no deposits. If there are, remove them and resume inspection under them.

Check that there are no discolorations caused by chemical attack, for instance. Chemical attack may weaken the hose. If the hose is used in environments where it may be subject to chemical attack, keep a detailed log.

>>> **NOTE**

Even if the equipment was cleaned as described in Section 2.3, contamination by chemicals may still harm the person servicing the equipment. Make sure that the hose has been thoroughly decontaminated and neutralised. Special training in decontamination and neutralising is needed.

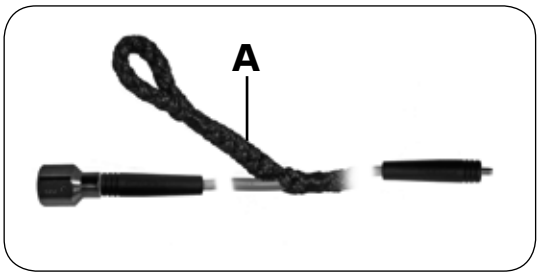
If you suspect that the hose has been affected by chemicals or that chemicals have penetrated the outer sheath, the hose should be replaced.

The lifetime of the high pressure hose is eight (8) years from when the hose was completely manufactured.

The year of manufacture is determined by the date for the pressure test stamped on the hose connection nipples in the format “P” + YY.

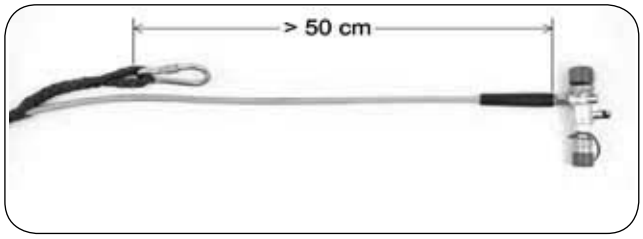
The eight (8) year life time applies only under the conditions that the hose is handled and inspected in accordance with safety bulletin “31574B01 – Divator DP1 Supply Hose/Lifeline”

▶ Relieving loops



Check the relieving loops (A) of the diving hose for wear and mechanical damage. Check that the whippings and tapings are intact.

Check that the free end of the supply hose connected to the MKII P+ regulator i minimum 50 cm (20 inch) loong (meassured from connection nipple to the releaving loop eye. according to illustration below).



▶ Safety belt, carbine hook

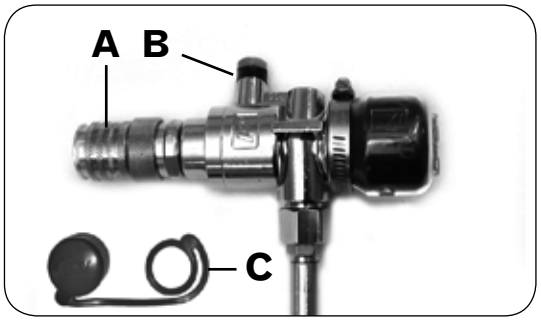
Check the seams and check for corrosion on the hooks. Check that the hooks run easily on the safety belt and that it locks. Check the seams and check that the belt has not suffered chemical attack, nor changed colour or shape.

Check the carbine hook for mechanical wear and changes of shape.

▶ **Connection R5/8" (#1)**

Check the thread and air holes for mechanical wear and deposits.

▶ **P+regulator**



▶▶ **Relief valve**

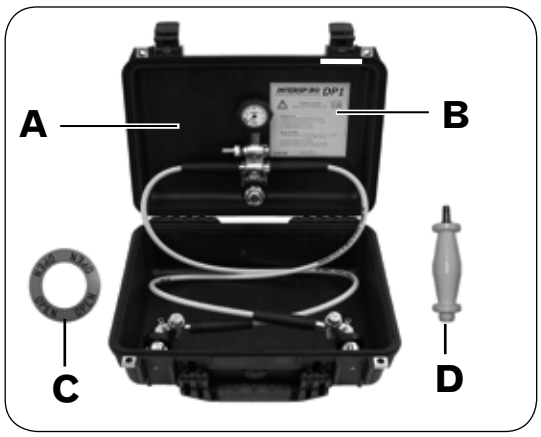
Check that the protective band (B) on the relief valve is not damaged. Check the safety valve for mechanical wear.

▶▶**Quick coupling**

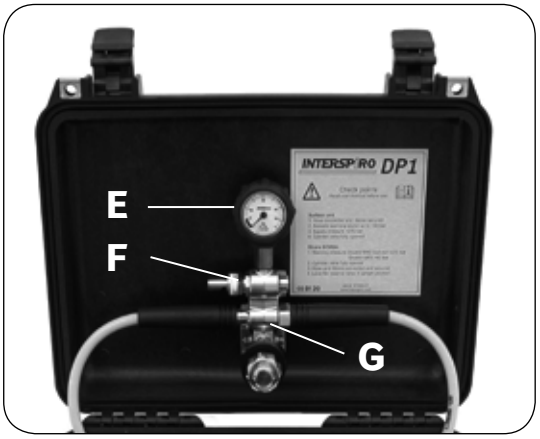
Check that the quick coupling (A) is undamaged and clean. Check for mechanical wear. Check that the quick coupling cover (C) is intact.

3.4.2 INSPECTING THE SURFACE UNIT

▶ **Surface panel box**



1. Check that the surface panel box (A) is undamaged and that the instruction label “Check points” (B) can be read.
2. Check that the “OPEN” ring (C) and the pressure relief handle (D) is present.



▶ **Valve block**

Check that the valve block has no mechanical damage.

▶▶**Pressure gauge**

Check that the pressure gauge (E) is free from scratches and other mechanical damage.

▶▶**Whistle insert**

Check the whistle insert.

Check that the retaining ring and locking clip (F) are in place.

▶▶**Shuttle insert**

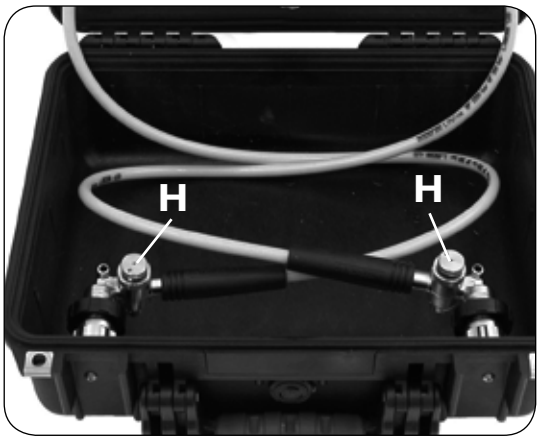
Check the shuttle insert (G) for deposits and mechanical damage.

Check that the shuttle insert can swivel.

Check that the retaining ring and locking clip are in place.

▸ Valve block / connection manifold

Check the valve block (H) for deposits and mechanical damage. Check that the venting part of the valve block can swivel.

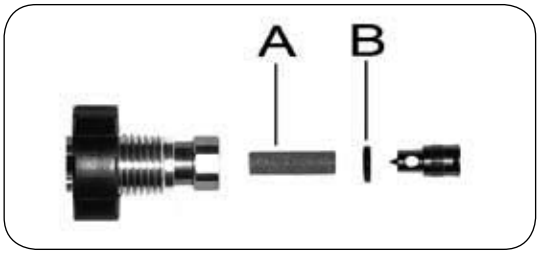


3.5 SIX-YEAR SERVICE

Content:

- Connection nippels - exchange Filter & O-rings
- T-pice - change O-rings
- Whistel insert - exchange of service components
- Shuttle insert - exchange of service components
- Vent insert - exchange of service components
- P+ regulator - exchange of service components

3.5.1 CONNECTION NIPPLES

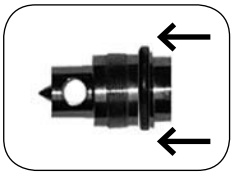


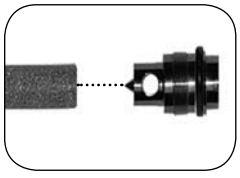
▸ Connection manifold and Valve block

▸▸Filter and O-rings

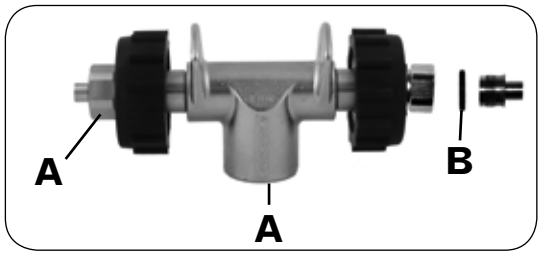
1. Unscrew and remove the nipple with help of a 5 mm hexagon wrench.
2. Remove and discard filter (A) fall out of the connection nipple

3. Carefully knock the connection nipple against a soft surface, to let that any possible loose particles fall out.
4. Remove and discard the O-ring (B) from the nipple.
5. Apply a thin layer of silicone lubrication on the a new O-ring (B) and position is in the grove of the nipple.
7. Drop a new filter (A) down into the connection nipple. The filter shall be centred so that the point of the nipple fits into the hole in the filter. Screw in and tighten the nipple by hand to stop using a 5 mm hexagonal wrench.





▸T-piece

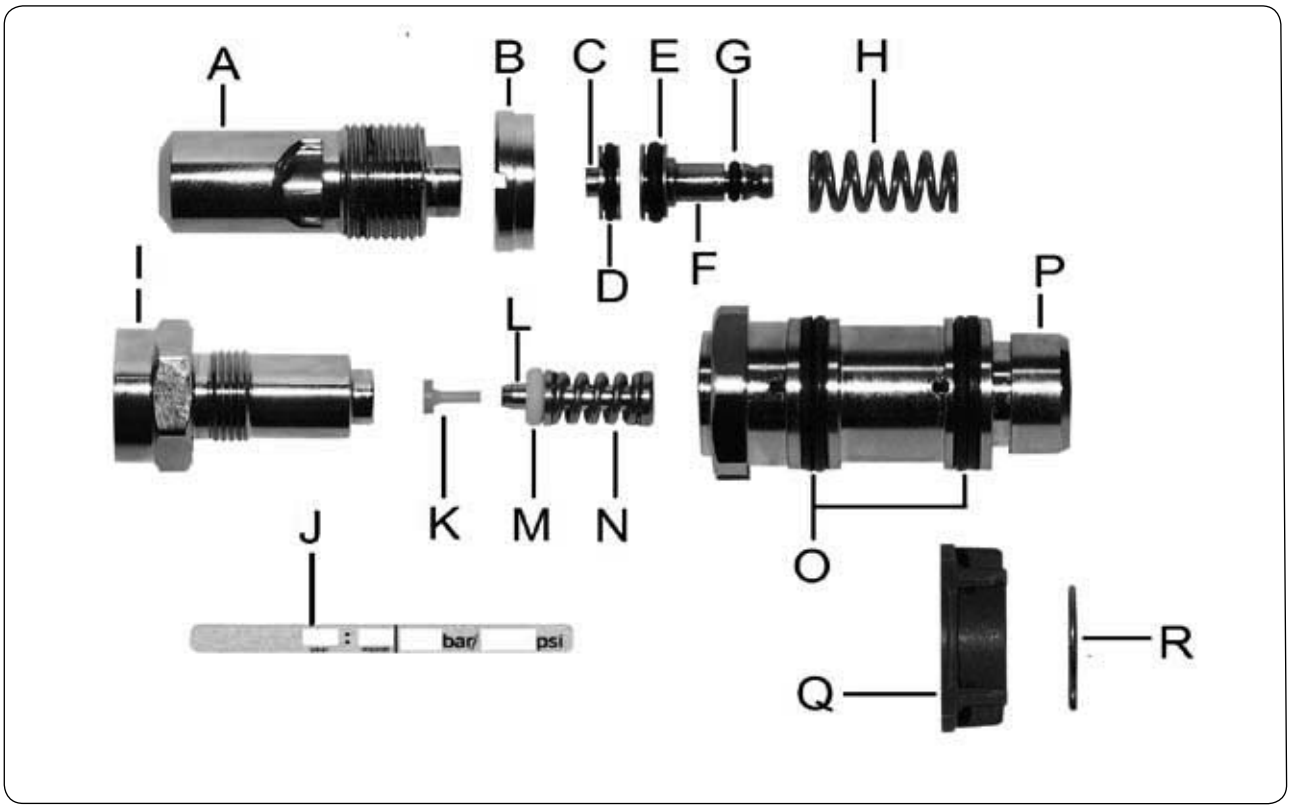


Check that the threaded connections (A) not are damaged.

▸Replace the O-rings

1. Unscrew and remove the nipples in both ends with help of a 5 mm hexagon wrench.
2. Remove and discard the O-rings (B) from the nipples and clean the threads from locking compound residue from.
3. Apply a thin later of silicone lubrication on two new O-rings and attach them in the groove on each nipple ends.
4. Apply two drops of locking compound on the threads of the nipple.
5. Fit the nipples into the connection nipples. Tighten the nipples gently by hand (torque 1 Nm).

3.5.2 WHISTLE INSERT



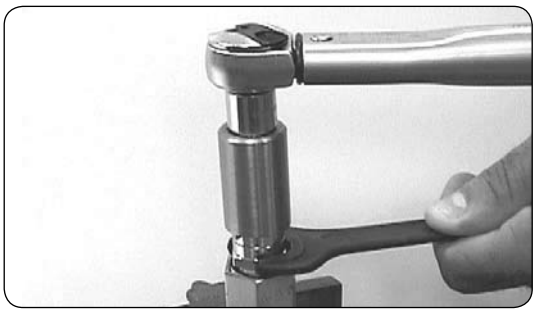
▶ Removing the whistle insert

1. Remove the retaining ring (Q).
2. Remove the locking clip (R) with the circlip pliers.

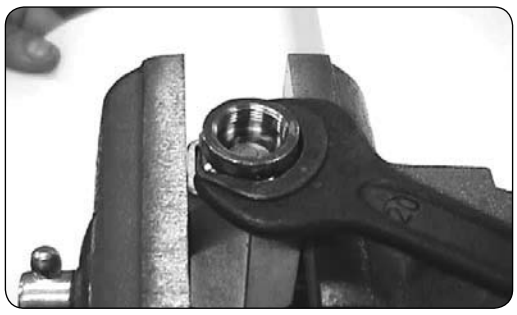
3. Pull out the whistle insert.

▶ Dismount the whistle insert

1. Remove the two O-rings with back-up rings (O) from the whistle insert cylinder.
2. Place the whistle unit in the plug-in whistle fixture and secure the fixture in the vice.
3. Hold the whistle cylinder (I) with a 20 mm U-spanner and loosen the locking nut (B) with the sleeve tool for the whistle.

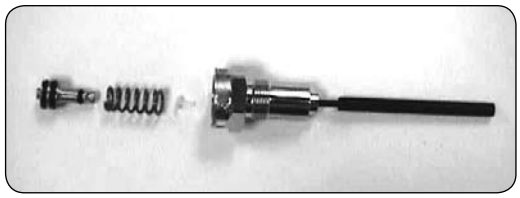


4. Remove the remains of sealing label (I).
5. Unscrew the whistle cylinder (I) with a 20 mm U-spanner.



6. Use the protective pin to press out the nozzle (C) and regulating piston (F).

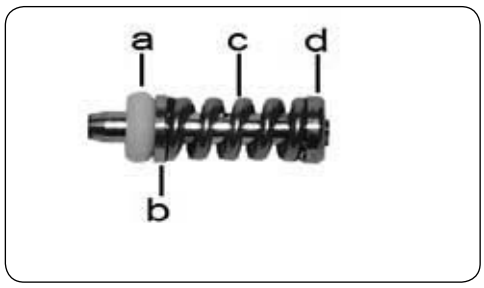
   Remove the O-rings (D, E and G).



7. Shake out the spring (H).
8. Tap the whistle insert cylinder (P) insert firmly against the workbench to extract the piston (F). Remove the and sealing cone (K), the O-ring (M) and the spring (N) from the piston (L).

▶ Fitting the whistle insert

1. Check that all parts have been cleaned and degreased. Make sure that all remains of the old sealing label (J) has been removed.
2. Lubricate piston and both ends of spring (N) with a thin coating of silicone lubricant.
3. Thread the spring (c), spring retainer (b), with its guide collar against the spring, and fit a new O-ring (a) on to piston (d).



4. Insert a new sealing cone (K) into piston (L). Insert the unit into the whistle insert cylinder (P).
5. Place the whistle insert cylinder (P) in the plug-in whistle fixture and secure the fixture in the vice.
6. Screw in the whistle cylinder (A) and tighten it with a 20 mm torque wrench to a torque of 20 Nm.
7. Check that the sealing cone (K) has been centred. Keep the whistle insert cylinder (P) in the whistle fixture until step 13 so that the cone does not get into the wrong position.
8. Lubricate the final turn of the spring (H) with a thin layer of silicone lubricant.
9. Lubricate two new O-rings (E) and (G) with a thin coating of silicone lubricant. Thread the O-rings on to the regulating piston (F), then the spring (H).
10. Insert the regulating piston into the whistle cylinder (I).
11. Lubricate a new O-ring (D) with a thin coating of silicone lubricant and fit it on nozzle (C).
12. Insert the nozzle in to the whistle cylinder.
13. Screw the whistle (A) down into the whistle cylinder (I) so that the locking nut covers the threads of the whistle when it has been tightened.
14. Lubricate two new O-rings and back-up rings (O) with a thin coating of silicone lubricant.

>>> **NOTE!**

It is important to install the O-rings and back-up rings (M) correctly. The order must be: from the groove nearest the whistle (A): back-up ring -> O-ring -> and in the next groove O-ring -> back-up ring. The O-rings are on the inside (the pressure side) and the back-up rings are on the outside.

15. Thread the whistle assembly tool on to the whistle insert cylinder (P), then a back-up ring (O) on to the tool.

16. Press by hand the back-up ring (part of O) over the assembly tool and down into the inner groove of the whistle insert cylinder.

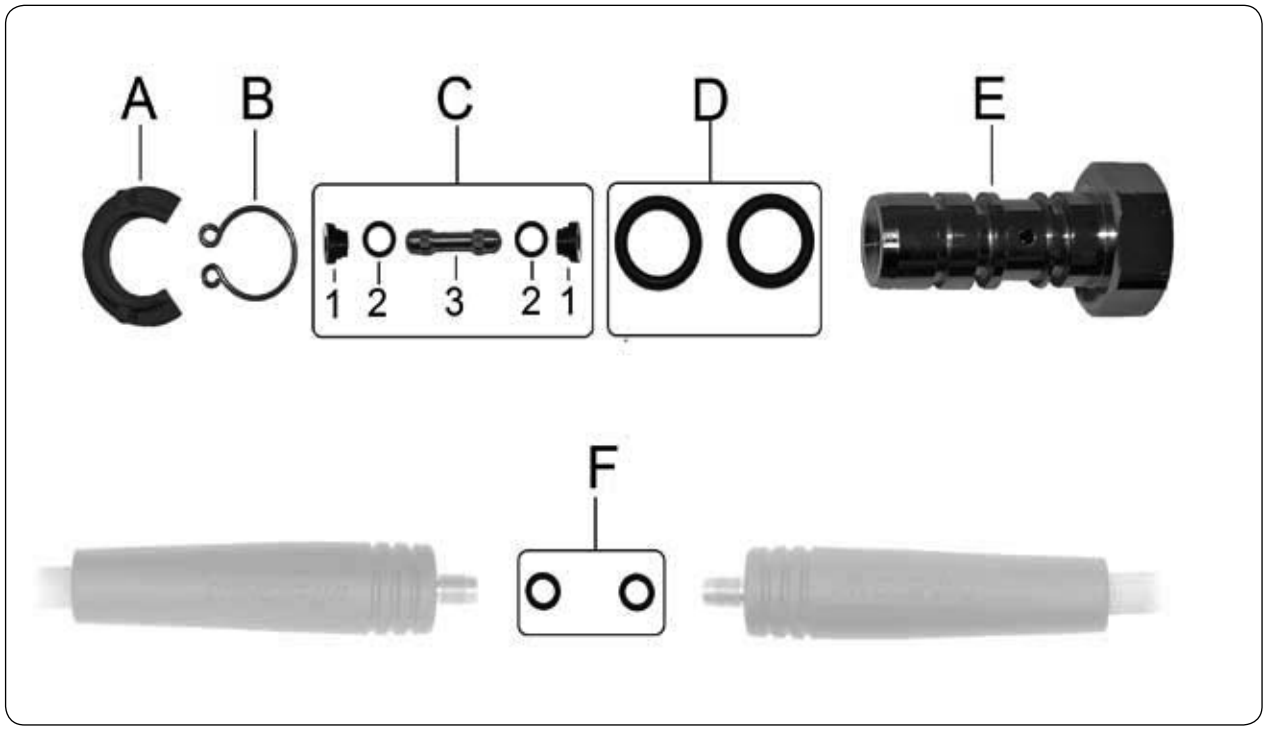
17. In the same way, but in the reverse order, fit the other O-ring and back-up ring (O) to the outer groove of the whistle insert cylinder.

18. Test and adjust the whistle as described in the Interspiro test instructions.
19. Lock the whistle with the locking nut (B) and sleeve tool, with a torque of 15 Nm.
20. Attach a new sealing label (J) with the warning pressure and date to the locking clip/whistle cylinder.
21. Push the whistle into the valve block.
22. Turn the whistle so that its opening points downwards.
23. Fit a new locking clip (R) and a new retaining ring (Q).

>>> **NOTE!**

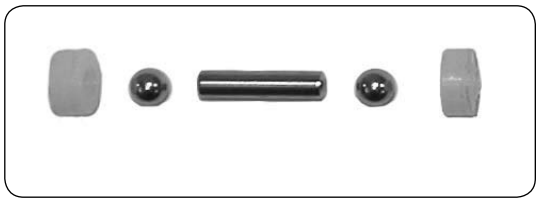
Check that the grips of the locking clip fit into the recesses in the retaining ring.

3.5.3 SHUTTLE INSERT



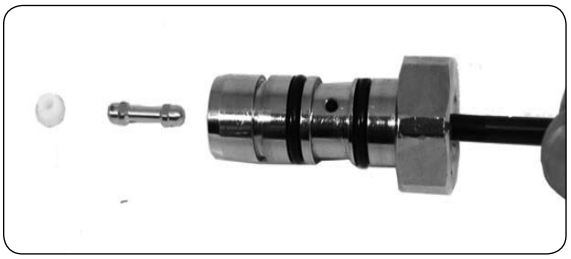
▶ Old versions of shuttle insert

Earlier versions of the Divator DP1 has the old type of shuttle kit as illustrated below. This shuttle kit was replaced in April 2006.



▶ Disassemble the shuttle insert

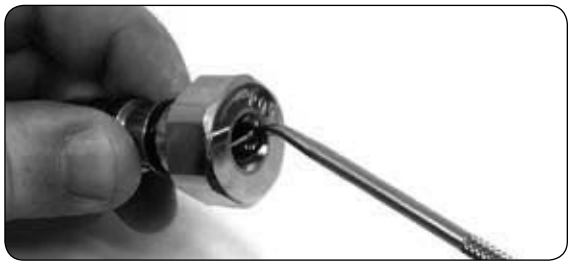
1. Pull back the hose bend protection.
2. Loosen and unscrew the two hoses with 13 mm and 24 mm U-spanners.
3. Remove and discard the O-ring (F) on both hoses.
4. Remove the retaining ring (A) by hand. Remove the locking clip (B) with help of a circlip pliers from the shuttle insert. Discard the retaining ring and the locking clips.
5. Pull out the shuttle insert (E).
6. Push out and discard the shuttle (C3) and the seat (C1) using the punch tool for shuttle valve.



7. Remove and discard the inner O-ring (C2) with the O-ring tool.

8. Turn the shuttle insert and push out and discard the other seat (C2) using the punch tool.

9. Remove and discard the inner O-ring (C2) the with the O-ring tool.



10. Remove and discard the two outer O-rings (D) on the shuttle insert housing.

▶ Assemble the shuttle insert.

1. Lubricate the new O-rings (C2) with a small amount of silicone lubricant.
2. Fit one O-ring onto a new seats (C1).
3. Fit the seat into the shuttle insert with help of the punch tool. Push the seat down to the bottom.

4. Lubricate the new O-rings (D) with a small amount of silicone lubricant.
5. Thread the assembly tool on to the shuttle insert and then place one O-ring (D) on the tool.

6. Push by hand the O-ring (D) over the assembly tool and down into the inner groove in the whistle insert.
7. Fit the other O-ring to the outer groove in the same way.
8. Lubricate the O-rings (F) with a small amount of silicone lubricant.
9. Fit the new O-rings (F) on the connection nipple of the hoses.
10. Screw one hose into the shuttle insert and tighten to 15 Nm using a 13 mm torque wrench. Put counter force with a 24 mm U-spanner.

11. Fit the shuttle insert with the mounted hose in the valve block.
12. Secure the shuttle insert with the locking clip (B) and retaining ring (A).

>>> **NOTE!**

Check that the grips of the locking clip (B) fit into the recesses in the retaining ring (A).

13. Fit the shuttle (C3) into the shuttle insert.

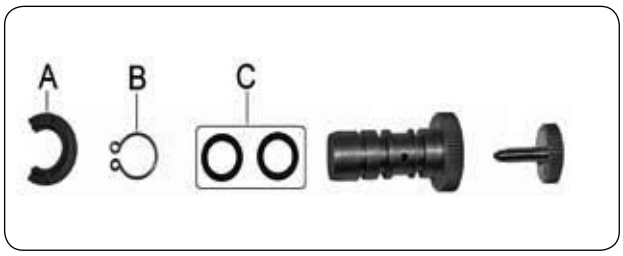
14. Fit the O-ring (C2) onto the second seat (C1)

    Fit the seat into the shuttle insert using punch tool. Push the seat down to the bottom.

15. Screw the second hose into the shuttle insert in the valve block.
16. Tighten the hose to 15 Nm with a 13 mm torque wrench and put counter force with a 24 mm U-spanner.

17. Push the hose bend protection back over the hose ends.

3.5.4 VENTING INSERT



▶ Removing the venting insert

1. Remove the retaining rings (A).
2. Remove the locking clips (B) with the circlip pliers.
3. Pull the venting inserts out of the connecting manifolds.
4. Remove and discard the O-rings (C).

▶ Fitting the venting insert

1. Lubricate the O-rings (C) with a thin coating of silicone lubricant.
2. Thread the assembly tool on to the venting insert and thread one O-ring (C) over the tool and puch the O-ring by hand down into the grove.
3. Fit the other O-ring to the outer groove in the same way.
4. Fit the venting insert into the connection manifolds.
6. Fit locking clips (B) and retaining rings (A).

>>> **NOTE!**

Check that the grips of the locking clip (#2) fit into the recesses in the retaining ring (#1).

3.5.5 P+ REGULATOR

▶ Important about the anti-freezing cap

Moisture can penetrate into the regulator from the air supply, damaged hoses, fittings or via the anti-freezing cap.

This moisture can lead to a risk of internal freezing but also cause corrosion inside the regulator. It is important to regularly inspect the antifreeze bladder with respect to moisture.

The antifreezing cap shall be replaced when performing the annual maintenance.

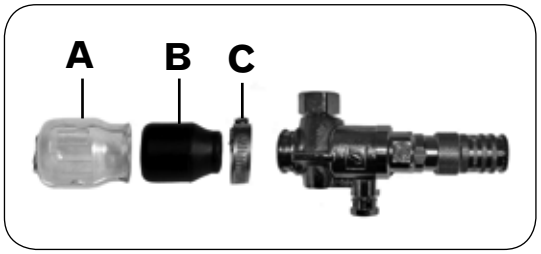
Antifreezing cap also functions as a pressure relief valve in case of a leak from the regulator.

It is therefore important to frostskyddshättan and its protective cover is mounted in the right way .

NOTE

A leaking anti-freezing cap not only increases the risk of freezing, it makes the regulator work less efficiently. Oxides and salt deposits in the regulator may adversely influence the high levels of performance associated with Interspiro products.

▶▶ Remove the anti-freezing cap



1. Remove the hose clamp (C) from the anti-freezing cover (A) with a screwdriver.

2. Open the hinged anti-freezing cover and remove the anti-freezing cap (B) from the groove on the regulator housing. Discard the antifreezing cap.

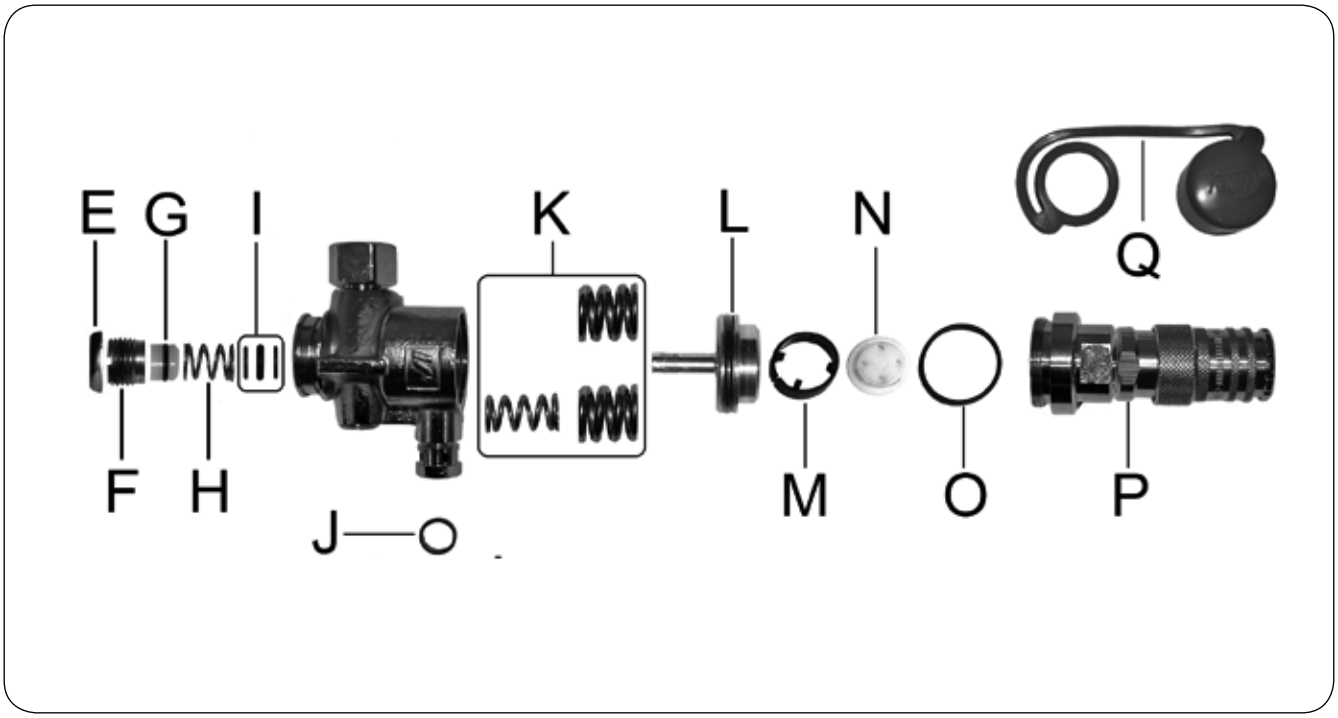
3. Check that no water has leaked in to the regulator. If water has leaked in the regulator must be blown dry completely.

▶ Remove the connecting hose.

1. Secure the regulator fixture and the regulator in the vice so that the coupling is facing upwards.
2. Pull back the hose bend restrictor and remove the hose (not the nipple) with 13 mm and 19 mm U-spanners.

3. Remove and discard the O-ring from the connection nipple.

▶ **Disassemble the P+ regulator**

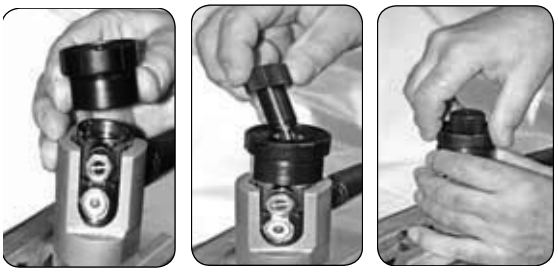


1. Screw off the regulator cover (P) including the quick coupling using a 21 mm U-spanner or the 21 mm torque wrench adapter.

2. Remove and discard O-ring (O) from the regulator cover.

   Remove the diffusor (M) and the stop ring (M).

3. Place the bottom part of the piston extractor tool on top of the open regulator. Screw the upper part of the piston extractor tool into the piston. Pull the piston out by screwing the bottom part. The piston may offer some resistance because of the back-up washers.



4. Take out the control spring set or control spring (K) depending on regulator version.

5. Remove and discard O-ring (L) from the piston.

6. Turn over the regulator in the regulator fixture.

7. Using the awl, remove and discard the sealing plate (E).

8. Using a screwdriver, unscrew the adjustment screw (F), turn over the regulator and take out and discard the valve seat with O-ring (G), save the spring (H).

9. Use the protective pin to press out the back-up washers and O-ring (I) from the top of the regulator and discard them.

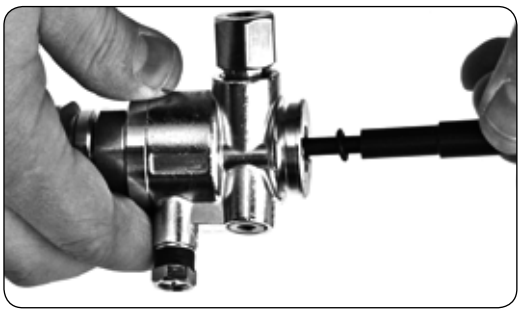
10. Check the adjustment screw (F) for damages. Remove old Loctite residues from the adjusting screw and in the regulator housing.

11. Clean the regulator housing with lint-free cloths and cotton buds.

▶ Fitting the P+ regulator

1. Apply a thin layer of silicone lubrication on all O-rings before assembly.
2. Fit a new O-ring (O) to the regulator cover (P).
3. Install diffusor (N) and stop ring (M).
4. Lubricate the piston shaft with silicone lubricant and fit O-ring (L) onto the piston.
5. Lubricate the control spring set or control spring (K) with silicone lubricant and fit it/them to the shaft of the piston.
6. Lubricate the piston location in the regulator housing.
7. Hold the regulator with the anti-freezing cap side up and place protective pin on piston (L). Push the Protective pin and the piston up into the regulator housing.
8. Turn over the regulator and place it in the regulator fixture with the piston facing up.

9. Fit cover (P) and tighten to a torque of 15 Nm with a 21 mm torque wrench.
10. Place protective pin in piston (L), place on of the back-up washers (I) on protective pin and press it down well with help of the punch tool.
11. Place O-ring (I) and the other back-up washer on the protective pin and press them firmly down, once more, with help of the punch tool. Remove the Protective pin and the punch tool.



12. Fit spring (H) over the piston shaft.
13. Fit O-ring (G) to valve seat.
14. Lubricate the entire valve seat, including the sealing surface.
15. The valve seat with O-ring (G) must be fitted with the chamfered side facing in towards the sealing tip of piston (L).
16. Set the adjustment screw (F) approximately by screwing it in until its back edge is flush with the thread entry of the regulator housing.

▶ Checking and adjusting the P+ regulator

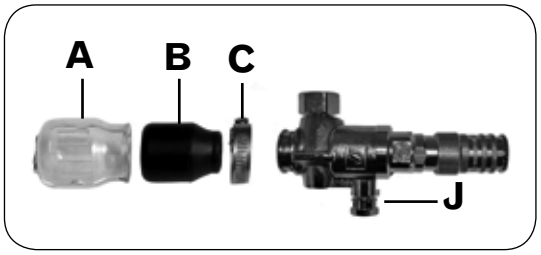
1. Connect the regulator in the Interspiro test equipment. For a general description of and operating instructions for the test unit, see Functional Description for the test equipment.
2. Adjust the secondary pressure according to the test instruction for Divator DP1 surface supply.
3. After adjustment secure the adjustment screw (F) with a drop of locking compound on the thread entry.

>>> **NOTE!**

Make sure that the locking compound does not cover the hole in adjusting screw (F).

4. Fit a new sealing plate (E) over the adjustment screw (F). Tap lightly with the flat side of the ball hammer until it is flush with the regulator housing. Then use the ball side of the hammer to lock the sealing plate.

▶ **Installing the anti-freezing cap**



1. Install the new anti-freezing cap (B) by carefully pulling it over the flange on the regulator. Gently pull on the lower edge of the anti-freezing cap, then release so that the anti-freezing cap is completely filled with air. There should now be a gap of about 1 mm so that the anti-freezing cover (A) can grip without pinching the anti-freezing cap (B).
2. Install the anti-freezing cover (A) and clamp (C) with a screwdriver so that the plastic halves do not pinch the anti-freezing cap (B) or crush the anti-freezing cap at any point. The clip must be tightened moderately. Check this by manually turning the anti-freezing cover (A). The anti-freezing cap (B) must not rotate with the anti-freezing cover (A).

▶ **Replacing the protective band**

1. Remove the protective band (J) from the relief valve and fit a new one.

▶ **Fitting a hose connection**

1. Lubricate the O-ring (A) with a thin coating of lubricant and position it in the groove on the hose nipple.
2. Fit the hose to the P+ regulator. Tighten to 15 Nm with a 13 mm torque wrench.
3. Push the hose bend restrictor back over the hose end.

3.5.6 TESTING

▶▶ **Testing in a test unit**

The DIVATOR DP1 must be tested with Interspiro test equipment at every annual or six-year inspection and after repair at a service workshop.

For a general description of and operating instructions for the test unit, see the user manual for the test equipment. Tests must be done in accordance with test protocol for DIVATOR DP1.

▶▶ **Logging of test results and comments**

Test results must be logged according to the instruction for the specific test equipment.

4 REPAIR

GENERAL INSTRUCTIONS

Preventive service for users is described in the user manual for DIVATOR DP1.

The instructions below describe the repair/replacement of:

- Hand wheel
- Connection nipple
- Pressure gauge
- Relieving loop
- Hose bend restrictor

TOOL INFORMATION

To make service easier, DIVATOR DP1 is largely assembled with threaded joints, allowing the replacement of individual parts instead of major components. In certain cases, threaded components must be tightened to a given torque, partly to achieve the desired strength and partly to avoid overloading the threads. The instructions state when a torque wrench must be used and specify the correct torque for each part.

LUBRICANTS, LOCKING COMPOUND AND DEGREASANTS

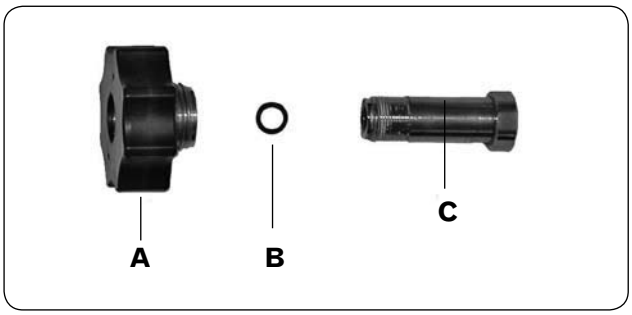
The instructions below specify lubricants and locking compound with part numbers; see under Tools in this manual. Locking compound must not come into contact with plastics or rubber parts. In other respects, follow the instructions for use and the safety regulations given by the manufacturer on the pack.

It is very important that surfaces which are to be treated with locking compound are completely free from grease and that every trace of old locking compound has been removed. Remove locking compound with a steel wire brush. Avoid touching the threads. Greasy and dirty parts must be degreased before locking compound is applied. It is advisable to use alcohol-based oil-free degreasants. After degreasing the parts, wipe them with a clean lint-free cloth.

Do not use degreasants on plastics or rubber parts.

4.1 REPAIR

4.1.1 REPLACING THE HAND WHEEL AND/OR THE CONNECTION NIPPLE



▶ **Tools**

- Socket, 19 mm	460 190 567
- Barrel brush	460 200 030
- U-spanner, 10/13 mm	460 190 774
- U-spanner, 24 mm	99 519-51
- Hexagonal key 5 mm	460 200 008
- Hexagonal key 3 mm	460 200 008
- Torque wrench adapter, 13/15 mm	460 190 852
- Torque wrench assy, 5-50 Nm	336 190 478
- O-ring tool kit	30 042-51
- Silicone lubricant	331 900 269
- Locking compound	460 190 846
- Manifold fixture	95 927-01

▶ **Dismounting the valve block**

1. Pull back the hose bend protector on the left side of the valve block.
2. Loosen and unscrew the left hose with 13 mm and 24 mm U-spanners.
3. Remove and discard the O-ring at the end of the hose.
4. Remove, by hand, the retaining rings on the shuttle valve as well as on whistle. Remove, with help of a circlip pliers, also the locking clips from the shuttle insert and the whistle.
5. Disconnect the whistle and the shuttle valve from the valve block.
6. Remove the valve block from the surface unit case. Start by loosing and unscrew the screw and nut in the bracket holding the valve block on the inside of the case lid. Use a U-spanner 10 mm and a 5 mm hexagon wrench.

   With help of a 3 mm hexagonal wrench unscrew the second screw for the valve block from the outside of the case lid.

7. Remove the valve block and attach it to the manifold fixture.
8. Loosen and unscrew the connection nipple (C) using a 19 mm socket fitted in the torque wrench.

   NOTE: Do not dismount the inlet filter.
9. Unscrew the connection nipple. Remove and discard the O-ring (B).

10. Clean the threads in the valve block and on the connection nipple from locking compound residuals with the barrel brush.

ASSEMBLING

1. Lubricate a new O-ring (B) with a thin layer of silicone lubricant and fit it to the end of the connection nipple.
2. Slide the (new) hand wheel (A) over the connection nipple (C).

   Apply a small amount of locking compound in three threads at the end of the connection nipple and screw it in to the regulator manifold.

3. Tighten the connection nipple with 20 Nm using a 19 mm socket and the torque wrench assy 5- 50 Nm.

4 Remove the valve block from the fixture and attach it to the bracket in surface panel lid.

5. Refit the valve block to the bracket in the surface unit case and secure it with the screw. Note the position of the two white gliding cases.

   Apply a drop of locking compound to the end of the screw and attach the nut and tighten it firmly, using a 10 mm U-spanner and a 5 mm hexagonal wrench.

6. Punch in the screw form the outside of the lid and fit the spacer.

   Apply a drop of locking compound at the end of the screw and fit it in the valve block. Tighten the screw firmly by hand using a 3 mm hexagonal wrench.

7. Reinstall the whistle and the shuttle valve with its hoses.

>>> **NOTE!**

Check that the grips of the locking clip fits into the recesses in the retaining ring.

8. Tighten the hose to 15 Nm with a 13 mm torque wrench and put counter force with a 24 mm U-spanner.

9 Push the hose bend restrictors back over the hose ends.

4.1.2 PRESSURE GAUGE

▶ Replacement of the pressure gauge

▶▶ Tools

-- U-spanner, 10/13 mm	460 190 774
- Hexagonal key 5 mm	460 200 008
- Hexagonal key 3 mm	460 200 522
- U-spanner 14-15 mm	460 190 769
- U-spanner 12 mm	31 236-51
- U-spanner, 24 mm	99 519-51
- Manifold fixture	95 927-01

▶ Consumable

- Locking compound	460 190 846

▶ Dismounting the valve block

1. Pull back the hose bend protector on the left side of the valve block.
2. Loosen and unscrew the left hose with 13 mm and 24 mm U-spanners.
3. Remove and discard the O-ring at the end of the hose.
4. Remove, by hand, the retaining rings on the shuttle valve as well as on whistle.
5. Remove, with help of a circlip pliers, also the locking clips from the shuttle insert and the whistle.
6. Disconnect the whistle and the shuttle valve from the valve block.
7. Remove the valve block from the surface unit case. Start by loosing and unscrew the screw and nut in the bracket holding the valve block on the inside of the case lid. Use a U-spanner 10 mm and a 5 mm hexagon wrench.

   With help of a 3 mm hexagonal wrench unscrew the second screw for the valve block from the outside of the case lid.

8. Remove the valve block and attach it to the manifold fixture.
9. Remove the valve block from the surface unit case. Start by loosening and unscrewing the screw and nut in the bracket holding the valve block on the inside of the case lid. Use a U-spanner 10 mm and a 5 mm hexagon wrench.

   With help of a 3 mm hexagonal wrench unscrew the second screw for the valve block from the outside of the case lid.

10. Remove the valve block and attach it to the manifold fixture
11. Use a U-spanner 12 mm to remove the pressure gauge and a U-spanner 15 mm as a counter hold.

    Remove and discard copper gasket.

12. Unscrew and remove the adapter from the valve block using a 15 mm U-spanner.
13 Clean, with the barrel brush, the threads on the Pressure gauge the adapter and the valve block.

▶ Fitting the pressure gauge

1. Apply two drops of locking compound to the male threads of the valve block.

   Fit the adapter to the male thread of the valve block so that there is a gap about 2 mm wide between the valve block and the adapter.

2. Apply two drops of locking compound to the male threads of the pressure gauge.
3. Hold the pressure gauge with the connection upwards and place a gasket in the recess in the pressure gauge.

4. Fit the valve block to the inverted pressure gauge.
5. Adjust the position of the adapter to give at least one half to one full turn to tighten the pressure gauge.

   Tighten the pressure gauge to correct position using a 13 mm and 15 mm open-end wrench.
6. Refit the valve block to the bracket in the surface unit case and secure it with the screw. Note the position of the two white gliding cases.

   Apply a drop of locking compound to the end of the screw and attach the nut and tighten it firmly, using a 10 mm U-spanner and a 5 mm hexagonal wrench.

7. Push in the screw form the outside of the lid and fit the spacer.

   Apply a drop of locking compound at the end of the screw and fit it in the valve block. Tighten the screw firmly by hand using a 3 mm hexagonal wrench.

8. Push the whistle into the valve block.
9. Turn the whistle so that its opening points downwards.
10. Fit a new locking clip and the retaining ring.

>>> **NOTE!**

Check that the grips of the locking clip fit into the recesses in the retaining ring.

11. Push the shuttle valve into the valve block.
12. Screw the second hose into the shuttle insert in the valve block.
13. Tighten the hose to 15 Nm with a 13 mm torque wrench and put counter force with a 24 mm U-spanner.

14. Push the hose bend protection back over the hose ends.

4.1.3 THE RELIEVING LOOP

▶ Replacement of the relieving loop

▶ ▶ Tools

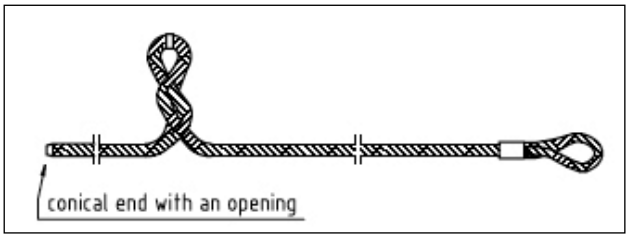
- Mounting tool	88 233-51
- U-spanner, 10/13 mm	460 190 774
- U-spanner, 24 mm	99 519-51
- Torque wrench adapter, 13/15 mm	460 190 852
- Torque wrench assy, 5-50 Nm	336 190 478

▶ Spare part

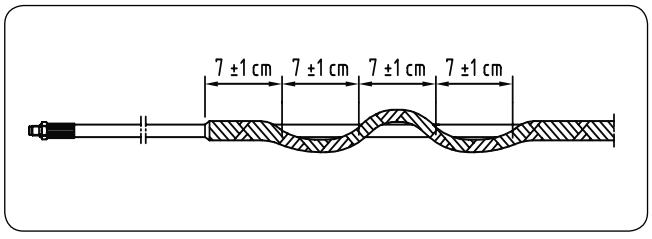
- Relieving Loop Kit	96 726-51

▶ Mounting the relieving loop

Unpack the two relieving loops and straighten them out. Relieving loop shall be mounted on the umbilical following the instruction below.



1. Guide the high-pressure hose through the opening in the conical end of the braided film. Open the braided film approx. 7 cm from the end and lead out the hose. Continue to stitch the hose through the braided film with approx. 7 cm space until two inserts has been done. Open the braided film 7 cm from the last insert and guide the hose into the braided film.

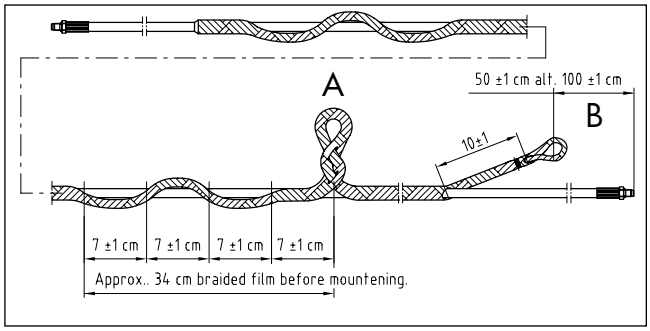


2. Guide the high-pressure hose the same way as above through the front part of the relieving loop.

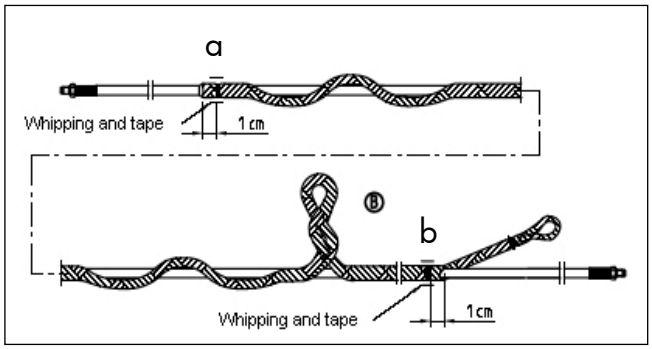
   Start with the first insert approx. 34 cm from the loop ”A”.

   Open the braided film approx. 7 cm from the end and lead out the hose. Continue to stitch the hose through the braided film with approx. 7 cm space until two inserts has been done.

   Open the braided film 7 cm from the last insert and guide the hose into the braided film, pass the loop “A” by guiding the hose out of and in to the braid under the loop “A”. Guide out the hose approx. 10 cm before the end loop “B” and pull out minimum 50 cm of the high-pressure hose.



3. Make a whipping, with the waxed line, part no. 96 739, at point “b” in Fig. 4. See the Whipping instruction in the chapter below.



4. Attach the carbine hook to loop “B” and fasten it to a fixed point. Pull back the braided film along the high-pressure hose so that it fits tight around the hose. Use a pair of protective gloves to avoid injuries (see Fig. 5). Secure the end of the braided film with a whipping at point “a” (Fig. 4).

5. Apply the whipping according to the instruction below

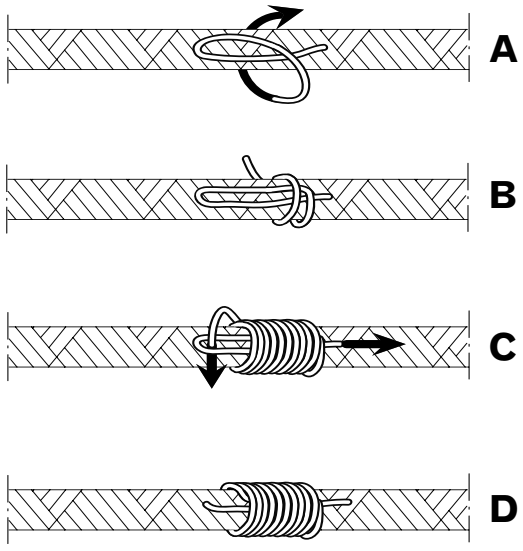
6. Repeat step 1-4 above to attach the relieving loop at the other end of the high-pressure hose.

▶ Whipping instruction

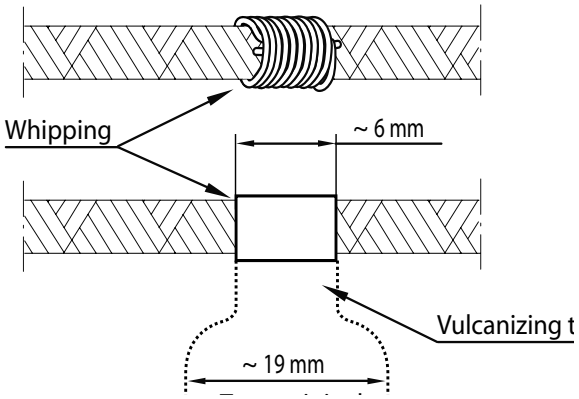
Preparations

In order to tighten the whipping enough wind the waxed line around a wooden pin or similar and use it as a handle when pulling the line.

1. The whipping is tied by laying a loop of the waxed whipping line along the rope (see illustration A -B).
2. Tie the whipping line hard 10–15 turns around the rope over the loop. The whipping will be approx. 5 mm wide (0.20 inch).
3. Stick the working end through the loop (see illustration C).
4. Haul the loop end back under the whipping so that booth ends of the whipping line are secured in the centre of the whipping. Trim both ends as short as possible(see illustration D).



5. Strip the protective foil on the vulcanizing tape.
6. Wrap under tension so the width of the tape will be reduced from 19 mm to approx. 6 mm (starts vulcanizing).
7. Wrap 4–6 turns so that the whipping is fully covered.



4.1.4 HOSE BEND RESTRICTOR

▶ Replacement of the hose bend restrictor

▶ ▶ Tools

- Mounting tool	88 233-51
- U-spanner, 10/13 mm	460 190 774
- U-spanner, 18/19 mm	460 190 775
- U-spanner, 24 mm	99 519-51
- Torque wrench adapter, 13/15 mm	460 190 852
- Torque wrench assy, 5-50 Nm	336 190 478

▶ Spare part

- Hose bend restrictor kit	460 190 917

▶ Remove the old hose bend restrictor.

1. Disconnect the high pressure hose from the P+regulator, hose connector or valve block what ever applies.

Pull off the old hose bend restrictor from the hose.

▶ Mounting the new hose bend restrictor

1. Connect the hose end to the mounting tool
2. Pull the new hose bend restrictor over the mounting tool and secure the open end of the tool in a vice.

   To easy the mounting soapy water on the hose to make the bend restrictor to slip on.
3. Make sure that the nut of the hose fitting i visible to make mounting of the hose possible
4. Remove the mounting tool
5. Connect the hose to the P+regulator, hose connector or valve block what ever applies.
6. Tighten the hose to 15 Nm with a 13 mm torque wrench and put counter force with a U-spanner that fits.

4.1.5 TESTING

▶▶ Testing in a test unit

The DIVATOR DP1 must be tested with Interspiro test equipment at every annual or six-year inspection and after repair at a service workshop.

For a general description of and operating instructions for the test unit, see the user manual for the test equipment. Tests must be done in accordance with test protocol for DIVATOR DP1.

▶▶ Logging of test results and comments

Test results must be logged according to the instruction for the specific test equipment.

5 STORAGE

■ All parts made of rubber or parts containing rubber components should be stored in a cool, dry and dark place and in a sealed plastic bag.

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